

ARI Research Note 98-30

## **Development of M1A2 Tank Platoon Exercises for Use in the Close Combat Tactical Trainer (CCTT)**

**William T. Holden and Don Forrest**  
Human Resources Research Organization

**Raymond E. Gray**  
Raytheon Systems Company

**Armored Forces Research Unit**  
**Barbara A. Black, Chief**

August 1998



**U.S. Army Research Institute  
for the Behavioral and Social Sciences**

Approved for public release; distribution is unlimited.

**DTIC QUALITY INSPECTED 1**

19980901 048

**U.S. Army Research Institute  
for the Behavioral and Social Sciences**

**A Directorate of the U.S. Total Army Personnel Command**

**EDGAR M. JOHNSON  
Director**

---

Research accomplished under contract  
for the Department of the Army

Human Resources Research Organization

Technical review by

Kathleen A. Quinkert

**NOTICES**

**DISTRIBUTION:** This Research Note has been cleared for release to the Defense Technical Information Center (DTIC) to comply with regulatory requirements. It has been given no primary distribution other than to DTIC and will be available only through DTIC or the National Technical Information Service (NTIS).

**FINAL DISPOSITION:** This Research Note may be destroyed when it is no longer needed. Please do not return it to the U.S. Army Research Institute for the Behavioral and Social Sciences.

**NOTE:** The views, opinions, and findings in this Research Note are those of the author(s) and should not be construed as an official Department of the Army position, policy, or decision unless so designated by other authorized documents.

REPORT DOCUMENTATION PAGE						
1. REPORT DATE (dd-mm-yy) August 1998		2. REPORT TYPE Final		3. DATES COVERED (from...to) April 1998 - August 1998		
4. TITLE AND SUBTITLE  Development of M1A2 Tank Platoon Exercises for Use in the Close Combat Tactical Trainer (CCTT)				5a. CONTRACT OR GRANT NUMBER DASW01-94-D-0011		
				5b. PROGRAM ELEMENT NUMBER O603007A		
6. AUTHOR(S)  Holden, William T. and Forrest, Don (HumRRO); Gray, Raymond E. (Raytheon)				5c. PROJECT NUMBER A793		
				5d. TASK NUMBER 2124		
				5e. WORK UNIT NUMBER R02		
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Human Resources Research Organization (HumRRO)      Raytheon Systems Company (Prime)    13775 McLearen Road 66 Canal Center Plaza, Suite 400                        Herndon, VA 22071-3212 Alexandria, VA 22314				8. PERFORMING ORGANIZATION REPORT NUMBER		
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) U.S. Army Research Institute for the Behavioral and Social Sciences ATTN: TAPC-ARI-IK 5001 Eisenhower Avenue Alexandria, VA 22333-5600				10. MONITOR ACRONYM ARI		
				11. MONITOR REPORT NUMBER Research Note 98-30		
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution is unlimited.						
13. SUPPLEMENTARY NOTES Billy L. Burnside, Contracting Officer's Representative						
14. ABSTRACT ( <i>Maximum 200 words:</i> ) This Research Note (RN) describes the development of M1A2 tank platoon exercises initiated as an added effort to the Structured Training for Units in the Close Combat Tactical Trainer-2 (STRUCCTT-2) Project. The effort had two objectives: to determine if the current CCTT M1A2 Intervehicular Information System (IVIS) system software replicates the actual fielded system with sufficient fidelity to provide positive training for the M1A2 tank crew; and to determine if the exercises that had been developed by the STRUCCTT and STRUCCTT-2 projects could be modified to provide interim M1A2 tank platoon training until the CCTT could be upgraded to support digital unit training. The RN describes the background for developing the exercises, covers some of the design considerations developed during the effort, provides an outline of the exercises that were created, and provides several lessons learned by the team undertaking the effort. The RN concludes with recommendations for further development of the CCTT to support digital unit training.						
15. SUBJECT TERMS Structured Training    Close Combat Tactical Trainer                          Training                          Combined Arms Tactical Training Training Aids Devices    Simulators    Simulations                          Simulation-Based Training                          Armor Training						
SECURITY CLASSIFICATION OF			19. LIMITATION OF ABSTRACT  Unlimited	20. NUMBER OF PAGES  21	21. RESPONSIBLE PERSON (Name and Telephone Number)  Billy L. Burnside (502) 624-2613	
16. REPORT Unclassified	17. ABSTRACT Unclassified	18. THIS PAGE Unclassified				

# DEVELOPMENT OF M1A2 TANK PLATOON EXERCISES FOR USE IN THE CLOSE COMBAT TACTICAL TRAINER (CCTT)

## CONTENTS

---

	Page
Introduction .....	1
Background .....	1
Technical Objectives.....	2
Methodology.....	2
Initial Decisions .....	2
M1A2 Tank Manned Module .....	3
After Action Review Workstation .....	4
BLUFOR Semi-Automated Forces Workstation.....	5
Designate Training Objectives.....	5
Design Scenarios .....	6
Develop Exercises and TSPs.....	10
Formative Evaluation.....	12
Lessons Learned.....	12
Use of an IVIS Tank.....	12
Number of Modules Available.....	13
Additional Information Needed for the TSP (IVIS Setup, Graphic Matrix, Reports) .....	13
Refresher Training for Crewmen of Digitally-equipped Combat Vehicles.....	14
Future Considerations .....	14
References .....	17

## LIST OF TABLES

Table 1. IVIS Overlays and Reports .....	4
2. Individual Digital Tasks.....	6
3. Comparison of Tank Heavy Versus Mechanized Infantry Company Team Task Organization.....	8

## CONTENTS (continued)

---

	Page
Table 4. M1A2 Tank Platoon Movement to Contact Mission Set.....	10
5. Tank Platoon Collective Tasks .....	11
6. IVIS Information Users.....	14
7. CCTT-D Research Project Recommendations .....	15

## LIST OF FIGURES

Figure 1. CCTT M1A2 tank exercises communication architecture.....	9
--	---

# DEVELOPMENT OF M1A2 TANK PLATOON EXERCISES FOR USE IN THE CLOSE COMBAT TACTICAL TRAINER (CCTT)

## Introduction

A project designated as Structured Training for Units in the Close Combat Tactical Trainer (STRUCCTT) was initiated in July 1996 in order to produce a structured training program that would incorporate associated tools, ensure effective and efficient use of the simulation, and support the fielding of the Close Combat Tactical Trainer (CCTT). A key requirement was to provide structured training exercises and associated training support packages (TSPs) to support the CCTT Initial Operational Test and Evaluation (IOT&E). The project created a library of M1A1 tank platoon, mechanized infantry platoon, and company team exercises along with a battalion task force exercise for use in the CCTT (Flynn, Campbell, Myers & Burnside, in preparation). The follow-on STRUCCTT-2 Project, established in August 1997, added to the CCTT exercise library by creating heavy cavalry troop and heavy scout platoon exercises as well as an additional battalion task force exercise (Deatz et al., in preparation). The development of M1A2 tank platoon exercises was initiated as an added effort to the STRUCCTT-2 Project. The effort had two objectives: to determine if the current CCTT M1A2 Intervehicular Information System (IVIS) system software replicates the actual fielded system with sufficient fidelity to provide positive training for the M1A2 tank crew; and to determine if the exercises that had been developed by the STRUCCTT and STRUCCTT-2 projects could be modified to provide interim M1A2 tank platoon training until the CCTT could be upgraded to support digital unit training.

## Background

In July 1997, the U.S. Army Research Institute for the Behavioral and Social Sciences, Armored Forces Research Unit, initiated the Training for the Digital Battlefield or the Close Combat Tactical Trainer - Digital (CCTT-D) research project to: (a) inventory digital capabilities of the CCTT, (b) devise an approach for exploiting current and future CCTT digital capabilities, and (c) design a training program that addresses those capabilities. The preliminary finding was that the CCTT, as it currently exists, doesn't adequately address the training needs or potential for units that are equipped with Force XXI Battle Command Brigade and Below (FBCB<sup>2</sup>) digital equipment (Dierksmeier et al, in preparation).

Several members of the STRUCCTT-2 Team were also participating in the CCTT-D research project and were familiar with the findings and recommendations the project was developing. As the STRUCCTT-2 Team completed work on its research project, some remaining resources were identified which could be used to begin to build on some of the findings of the CCTT-D Project. In April 1998, the STRUCCTT-2 Team requested authorization from the Contracting Officer's Representative (COR) to initiate development of specific modifications to the structured M1A1 tank platoon exercises that were developed during the initial STRUCCTT Project. If the modifications were successful, they could serve as interim M1A2 tank platoon training exercises until the recommendations of the CCTT-D Project regarding fielding of FBCB<sup>2</sup>

in CCTT are implemented and the digital tank platoon training exercises designed by the CCTT-D Project are developed and implemented. With approval from the COR, the STRUCCTT-2 Team began the development process.

### Technical Objectives

The STRUCCTT-2 Team's proposal for the follow-on effort had the following objectives:

1. To design M1A2-specific modifications to the CCTT training exercises that were developed under the STRUCCTT project for M1A1 platoons. These exercises would serve first as a trial of the design and development for CCTT-D. They would also serve as interim training exercises until FBCB<sup>2</sup> equipment is fielded in CCTT and the tank platoon training exercises designed by the CCTT-D project are developed and implemented.
2. To develop the complete exercises and training support packages (TSPs) for a limited set of M1A2 tank platoon exercises, as directed by the Contracting Officer's Representative (COR).
3. To formatively evaluate and revise the developed exercises and TSPs, based on their implementation with at least one M1A2 tank platoon at Fort Knox.
4. To document lessons learned to support future development of M1A2 exercises and TSPs for the CCTT and other simulations.

Within the scope of work that the STRUCCTT-2 Team had proposed, four tasks were identified: to prepare a plan for the effort; to design a comprehensive set of exercises for training M1A2 tank platoons in the CCTT; to develop and evaluate the TSPs for selected M1A2 tank platoon exercises in accordance with the training design approved by the COR; and, to document lessons learned to support future development of M1A2 exercises and TSPs for the CCTT and other simulations.

### Methodology

During a formal briefing to the COR and other interested Army agencies, the team presented the activities, deliverables, and a time line for the effort rather than preparing a comprehensive project execution plan due to the limited time between the initiation of the development and the scheduled end of the STRUCCTT-2 Project. As part of the briefing, the team also presented a recommendation for the training design of the M1A2 tank platoon exercises. With some modification, the plan and training design were approved by the COR.

### Initial Decisions

Prior to making the initial decisions regarding the development of M1A2 exercises, the design team had to answer several key questions about the capabilities and/or limitations of the CCTT in supporting M1A2 training. Some of the questions examined were:

- How well does the CCTT's M1A2 tank manned module replicate the digital functionality of the actual vehicle.?

- How well does the CCTT system as a whole replicate company/team level digital capabilities?
- What additional requirements, if any, are required to support M1A2 tank platoon training in the CCTT when compared to M1A1 tank platoon training?

### M1A2 Tank Manned Module

The CCTT M1A2 manned module provides a realistic replication of the M1A2 tank and its digital systems. The Commander's Independent Thermal Viewer (CITV) is a fully integrated, full-target engagement thermal sight designed to provide the M1A2 tank commander (TC) with redundant target acquisition and engagement capabilities equivalent to the Gunner's Primary Sight/Thermal Imaging System (GPS/TIS). The TC can independently search for targets with the CITV while the gunner engages targets using other sight systems, thereby increasing crew lethality and survivability. Once the TC has identified a target he can "designate" (move) the main gun to the target and "hand-off" the target to the gunner for engagement, or engage the target himself. Additionally, the TC can use the CITV to view GPS/TIS gun line of sight (GUN LOS) as seen by the gunner through the GPS/TIS (Department of the Army [DA], 1995).

The CITV replicated in the CCTT M1A2 manned module worked very well and provided no training development problems. A minor operational concern was discovered concerning the interaction between the CCTT CITV and the head tracker system. The M1A2 manned module uses a head tracker system consisting of a transmitter and receiver to monitor head position at the TC station. The transmitter is attached to the top of the combat vehicle crewman's (CVC) helmet worn by the TC and the receiver is embedded directly above his station. The head tracker sensor feeds data received from the transmitter to an Image Generator which turns on or off visual displays based on where the TC's head is positioned (assumed line of vision) in relation to the turret. The CCTT M1A2 manned module, replicating the actual vehicle, gives the TC the option of either standing on the TC's platform and looking out of the turret in the "protected open" hatch position or remaining seated within the turret on the TC's seat. In the actual vehicle, the TC, while "standing" in the protected open hatch position, is able to glance down into the turret and visually monitor the CITV thermal picture. However, in the CCTT M1A2 manned module the CITV "blanks" out when the TC is standing in the protected open position. The head tracker system assumes that because the TC is standing in the protected open hatch position, he doesn't need the CITV and blanks it out. While this situation may be annoying, it doesn't create a serious training distractor.

The IVIS system allows platoon leaders and vehicle commanders to create and process data in a digital format. The system can be used to send and receive automated tactical overlays and reports between echelons. In addition, IVIS enhances situational awareness on the battlefield with integration of the position navigation system (POSNAV) (DA, 1995). The M1A2 manned module accurately replicates the IVIS system found on the M1A2 tank. After logging on, one can send and receive reports, and prepare, send and receive overlays. Table 1 lists the overlays and reports available in IVIS.



Table 1

IVIS Overlays and Reports

Overlays	Reports
Enemy Overlay	Contact Report
Fire Support Overlay	Spot Report
Obstacle Overlay	Situation Report
Operations Overlay #1	Call for Fire
Operations Overlay #2	Tactical Fire Direction System (TACFIRE) Report
	Medical Evacuation (MEDEVAC) Request Report

Of the reports and overlays listed, the MEDEVAC request is not available for use in the CCTT M1A2 manned module. Until digital systems are fielded to the total force, this IVIS report has been disabled since there is no higher headquarters element replicated in the CCTT system that could receive the report and act on it in the simulation. All other reports and overlays are available in the CCTT.

The POSNAV is a component of IVIS and an integral part of the M1A2 manned module. The POSNAV in the CCTT provides a reading of the M1A2 modules' location on the database based on an initial location entered during exercise planning. On the actual tank the crew must enter their initial location and initialize the POSNAV system. The M1A2 manned module position is preset in the IVIS system as part of the exercise file and does not require the crew to input their initial position; however in the exercise preview it is recommended that the crews check their position prior to beginning the exercise.

The Driver's Integrated Display (DID) shows the driver the status of tank hull systems, controls starting and shutdown of engine, light, and auxiliary systems, and alerts the driver to unusual or dangerous condition in the tank system. It also gives the driver a steer-to function that allows the tank commander to provide him with a graphic representation of the direction and distance to travel. The system then updates the distance to the waypoint, the deviation off course, and the direction the driver must steer to get back on course. The CCTT accurately replicates the M1A2's DID functionality and capabilities (DA, 1995).

#### After Action Review (AAR) Workstation

The CCTT AAR workstation allows the observer/controller (O/C) to monitor and control exercises and review training performance. The AAR workstation can also record and playback an exercise for use in an AAR presented by the O/C. The AAR workstation has the capability for the O/C and/or AAR workstation operator to send and receive voice transmissions but does not have the capability to prepare, send or receive digital transmissions. This limits the O/C's ability to review performance of M1A2 training. It also increases the number of modules and personnel needed to control the exercise as will be discussed later in this report.

## Blue Forces (BLUFOR) Semi-Automated Forces (SAF) Workstation

The BLUFOR SAF Workstation controls computer-generated forces that replicate other friendly units on the battlefield for the training unit. The BLUFOR SAF Workstation can portray M1A2-equipped tank platoons and companies, although the situational awareness, navigation, and target detection and engagement capabilities are not increased over an M1A1 SAF platoon. The M1A2 SAF platoon is not capable of digital communications with the M1A2 training platoon, and M1A2 SAF vehicles do not show up on the training platoon's IVIS displays. These limitations can be addressed by having the BLUFOR SAF Workstation operator role-play as adjacent platoon leaders in providing unilateral cross talk via voice transmissions. This allows the manned platoon to maintain situational awareness of the other platoons in the team.

### Designate Training Objectives

Prior to the development phase of the M1A2 exercises, the STRUCCTT-2 Team needed to identify those specific collective and individual training tasks involving the use of digital equipment or training techniques and procedures which the CCTT could support for training exercises. The intent was to create conditions in exercises which would cause the crew to have to rely on the digital capabilities (IVIS, CITV, and DID) of the vehicle rather than just the visual and thermal target acquisition and standard voice radio communications used in the existing M1A1 tank platoon exercises.

As a baseline, the STRUCCTT-2 Team determined that all exercises developed should be done during night conditions to maximize the use of the M1A2 capabilities. The CCTT provides an accurate, detailed visual representation of the terrain at the National Training Center (NTC). With many soldiers intimately familiar with the NTC terrain, degrading their ability to employ terrain association techniques for controlling their maneuver was expected to increase their reliance on the M1A2 POSNAV system. Additionally, operating under night conditions would negate the tank commander's ability to visually scan the terrain for target acquisition by using his "popped hatch" capability in the module. The intent was to force the tank commander to rely on his CITV to perform this scanning function independent of the scanning the gunner would be doing with his thermal sights. The determination to conduct these exercises under night conditions was not expected to significantly impact on the gunner, based on the team's previous military experience and from observation of CCTT M1A2 tank platoon training which showed that gunners use their thermal sight regardless of the ambient light conditions. In CCTT, the loader has a limited view outside of the manned module and is not affected by light conditions.

The STRUCCTT-2 Team's review of ARTEP 17-237-10-MTP (DA, 1996) which was written for platoon leaders and members of M60A3, M1, M1A1, and M1A2 tank platoons did not reveal any specific collective digital tasks in the training and evaluation outlines. Where appropriate, individual task steps were annotated with a reference to use a digital or M1A2 specific system or weapon. Without a requirement to establish the conditions needed to train specific digital collective tasks, the STRUCCTT-2 Team was able to begin designing scenarios with a greater degree of latitude than had been originally envisioned when the development effort started.

The STRUCCTT-2 Team also focused on the tank commanders, primarily the platoon leader (PL) and secondarily the platoon sergeant (PSG), as the key individuals in digitally training the platoon. While the other platoon members could benefit from using the POSNAV system and the CITV, the PL and PSG were the individuals who tied the individual tanks together into a digital fighting force. To gain additional insight on digital tasks that could be trained within the current CCTT, the STRUCCTT-2 Team used the draft M1A2 Individual Task List (United States Army Armor Center [USAARMC], 1998) which is under development by the Analysis Branch, Directorate of Training and Doctrine Development, U.S. Army Armor Center and School. The STRUCCTT-2 Team identified several individual digital tasks (Table 2) that were appropriate for training in CCTT.

Table 2

Individual Digital Tasks

Task Number	Task Title
171-121-1130	Send and Receive Tactical Report/Overlays on the Commander's Integrated Display (CID) on the M1A2 Tank
171-121-1113	Operate the Commander's Integrated Display (CID) on an M1A2 Tank
171-126-1111	Operate the Driver's Integrated Display (DID) on an M1A2 Tank
171-126-1136	Drive an M1A2 Tank
171-126-1143	Operate the Commander's Independent Thermal Viewer (CITV) on an M1A2 Tank
171-126-3004	Engage Targets with the Main Gun from the Commander's Weapon Station on an M1/M1A1/M1A2 Tank
171-126-3010	Direct Main Gun Engagements on an M1/M1A1/M1A2 Tank

Source: USAARMC M1A2 Equipment Task List

Design Scenarios

The STRUCCTT-2 Team considered the following missions upon which to base the M1A2 tank platoon exercises:

- Movement to contact,
- Deliberate attack, and
- Defend in sector.

These missions were included in the structured CCTT exercises that had previously been developed by the STRUCCTT-2 Team based on the CCTT's National Training Center terrain database. For all of the missions, company team operations orders and overlays were available upon which to base platoon operations orders.

In analyzing the missions, the STRUCCTT-2 Team felt that the movement to contact mission was the best fit in terms of the objectives of the project and the team's available resources. Two M1A1 platoon exercises had already been developed for this mission. The existing tactical materials could be used with minor modifications. Once created, exercises based

on a movement to contact mission would give units the greatest amount of flexibility in changing conditions to meet their specific needs.

The STRUCCTT-2 Team had not developed platoon-level deliberate attack exercises. A balanced company team exercise focusing on a deliberate breach of an obstacle was available, but limitations in the CCTT functionality mitigated against such a course of action. As of May 1997, the M1A1 and M1A2 tank manned modules could not be fitted with rollers and plows so that they could breach a minefield. Any training involving this mission would put the M1A2 platoon into a support by fire or overwatch mission which would not maximize the number of M1A2 tasks the platoon could perform.

There was an M1A1 tank platoon defense exercise which could be modified for use by an M1A2 platoon. The STRUCCTT-2 Team felt that this exercise would have very limited utility for two reasons. First, once created, it would be very difficult for units to modify the conditions associated with this mission. The defense is based on a task force defend in sector mission with three company teams defending from mutually supporting battle positions with prepared fighting positions and integrated obstacles. If changes were made, then the CCTT electronic exercise files would have to be substantially modified as well as new tactical orders and overlays prepared. Secondly, and more importantly, the platoon would require a fully digitized company team headquarters integrated into a digitized task force that would be providing the training platoon with an increasing amount of digital situation reports and updated overlays of opposing force (OPFOR) formations as they closed in. The CCTT does not currently have the capability to provide this information.

A major design challenge for the STRUCCTT-2 Team was to determine the M1A2 tank platoon's team headquarters. The team considered two courses of action: the M1A2 tank platoon would be subordinate to a tank heavy company team or it would be subordinate to a mechanized infantry (mech) heavy company team. Table 3 compares the two selected courses of action.

A third potential course of action, which was to subordinate the M1A2 tank platoon to an M1A2 tank pure company, was not considered because the STRUCCTT Team had not previously created platoon exercises based on that task organization which could then be modified to support M1A2 training exercises. Additionally, adding a second computer-generated M1A2 tank platoon would cause an even greater disparity between the tactical situational awareness that the training platoon expected to see and what the CCTT IVIS would actually display.

Based on its digital research and experience with the CCTT, the STRUCCTT-2 Team recommended during a design review chaired by the COR that the M1A2 tank platoon exercise be based on a mechanized infantry heavy company team performing a movement to contact mission. The COR concurred with the recommendation of the movement to contact mission but directed that the team use a tank heavy company team task organization if feasible. As a result, the training platoon would be part of a tank heavy team with two M1A2-equipped tank platoons (the training platoon and one SAF-generated) and an SAF mechanized infantry platoon with M2A2 Bradley Fighting Vehicles. If this were an actual tank heavy team, the two M1A2 platoons would

have situational awareness of each other via IVIS and would be able to send and receive digital reports to each other as well as to the team commander.

Table 3

Comparison of Tank Heavy Versus Mechanized Infantry Company Team Task Organization

Tank heavy team	Mech heavy team
<ul style="list-style-type: none"> <li>• Adjacent M1A2 platoon won't appear on IVIS unless manually entered by O/C in another tank.</li> <li>• Team Commander (Cdr) and Executive Officer (XO) digital capabilities can't be replicated simultaneously.</li> <li>• M1A2 tank platoons could not be trained at Fort Knox CCTT Site with this task organization (as of May 1998) without modifying the STRUCCTT-2 Team's control and evaluation plan.</li> <li>• This design could be expanded to tank team-level training.</li> </ul>	<ul style="list-style-type: none"> <li>• No adjacent M1A2 tank platoon considerations.</li> <li>• Team headquarters would not be digital capable.</li> <li>• M1A2 platoons could be trained at Fort Knox.</li> <li>• No capability to expand to tank team-level training.</li> </ul>

As the STRUCCTT-2 Team implemented this course of action, the architecture of the company team communications network in which the M1A2 tank platoon operated was a key consideration for the design of the exercise observer/controller (O/C) function and the tools he would have to have to control and evaluate the platoon's performance. Figure 1 depicts the communications architecture the team established for the exercises.

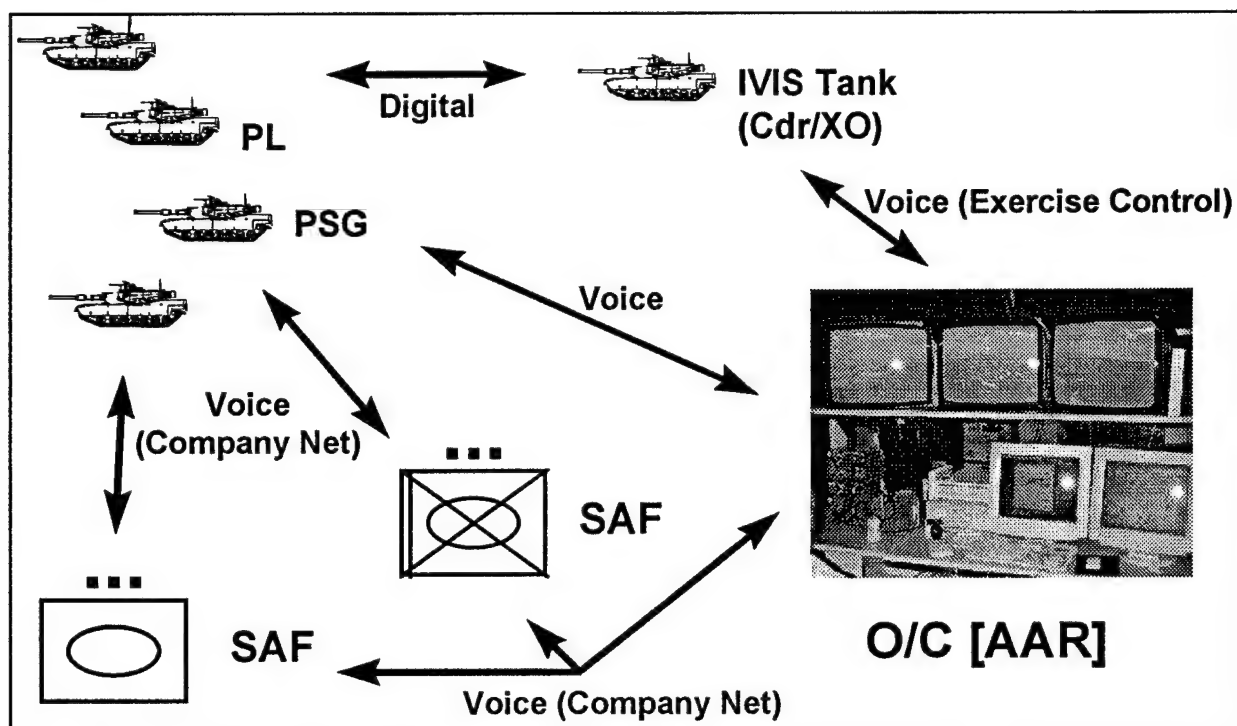


Figure 1. CCTT M1A2 tank exercises communication architecture.

To overcome the CCTT's current limitation of not allowing the O/C to monitor digital communications, as well as the training platoon not having situational awareness of its sister tank platoon, the STRUCCTT-2 Team established a requirement for an "IVIS Tank." The team decided to use that term rather than "O/C Tank" or some other designation to prevent confusion among trainers and the training audience about the physical location and the responsibilities of the O/C. The IVIS Tank is an additional M1A2 tank manned module, recommended to be operated by the tank company commander or executive officer's tank crew, which would be controlled by the O/C and replicate both the company team commander and the company executive officer's tank during the exercise. This tank would send scripted digital messages to the M1A2 tank platoon leader and report to the O/C by voice net the receipt and content of digital messages from the platoon. The absence of digital information about the location of the computer-generated adjacent M1A2 tank platoon which the training unit platoon leader and platoon sergeant would expect to see displayed on their IVIS system was to be explained during the exercise pre-brief to the platoon as a CCTT limitation. The adjacent tank platoon and mechanized infantry platoon would be controlled by the O/C, acting as the company team commander sending voice messages on the company team net. The SAF workstation operator, acting as the adjacent tank platoon and mechanized platoon leaders, would send periodic situation reports as needed, again on the company team voice net.

The M1A2 tank platoon's use of the IVIS system for internal communications would be monitored and evaluated through monitoring of the platoon voice radio net by the O/C to ascertain if the platoon was using voice messages to send information that could be sent digitally. For example, the company team executive officer would ask the platoon sergeant for a digital situation report. If the platoon sergeant directed the other tanks in the platoon to send him their



status by voice message rather than digitally, the O/C could determine that the platoon was not fully using its IVIS messaging capabilities.

### Develop Exercises and TSPs

Before beginning to work on the M1A2 tank platoon exercises, the STRUCCTT-2 Team anticipated that a minimum of five M1A2 tank platoon exercises in the selected mission set would be developed to include all components and address all requirements included in the original STRUCCTT exercises and TSPs, with the exception of performance demonstrations. The TSPs would include all required operations orders, supporting graphics, and other preparatory material, as well as train-the-trainer material, specific to M1A2 tank platoon training and they would be consistent with the STRUCCTT materials.

As development of the exercises began, the STRUCCTT-2 Team determined that the existing tank platoon exercises, based on a tank heavy company leading the task force diamond formation in a movement to contact, would not provide sufficient latitude, given the current CCTT digital limitations, to create tactical conditions that would force the M1A2 tank platoon to use its IVIS system to successfully accomplish a mission. The team decided that having the parent tank heavy company team occupy the right flank (northern position) in the task force formation would keep it out of the initial contact with Opposing Force (OPFOR) units and allow wide latitude in subsequent maneuver by the company team. The team then created a set of four interrelated exercises (Table 4) for the M1A2 tank platoon. The exercises were identified for inclusion in the STRUCCTT TSP library and for access in the CCTT exercise directory structure in the same manner as had been used in the preceding STRUCCTT projects. The naming convention is P(latoon) A(rmor) M(ovement to contact) 1(exercise number)\_M1A2 (pertains to M1A2 tank vice M1A1 tank) or PAM1\_M1A2.

Table 4

#### M1A2 Tank Platoon Movement to Contact Mission Set

Exercise	STRUCCTT TSP designation CCTT electronic file name	Title
1	PAM1_M1A2	Tactical Movement
2	PAM2_M1A2	Actions on Contact
3	PAM3_M1A2	Fragmentary Order
4	PAM4_M1A2	Attack by Fire

During the design of the exercises, the STRUCCTT-2 Team focused on creating conditions for tasks that would allow the platoon to maximize the use of the unique capabilities of the M1A2 tank. A discussion of each exercise follows:

Exercise 1 allows the platoon to become familiar with the CCTT data base, the CCTT M1A2 manned modules, and to develop situational awareness in the CCTT environment while conducting a mission. This exercise also allows sustainment training on M1A2 unique procedures

such as: log-on procedures, IVIS, CITV and POSNAV setup and usage. The platoon leader, based on an operations order given by the O/C, conducts troop leading procedures, prepares, edits, posts, and sends operational graphics to the platoon via the IVIS. This exercise has no enemy.

During Exercise 2, the platoon conducts actions on contact with an enemy combat reconnaissance patrol (CRP). During this exercise the M1A2 tank drivers use the steer-to waypoint function of the DID to conduct tactical movement. Tank commanders search for and engage the enemy using the CITV. Also, the tank commanders send IVIS reports and monitor the IVIS for platoon situational awareness.

In Exercise 3, the platoon leader receives a fragmentary order (FRAGO) and digital graphics from the team commander ordering a change of mission to move to and occupy an attack by fire (ABF) position and conduct an ABF. The platoon leader analyzes the order and issues digital graphics via IVIS to the platoon. At the PL's direction, the platoon begins tactical movement toward the ABF position with the drivers using the DID's steer-to waypoint function to aid in navigation. Tank commanders, using the CITV, identify and destroy an enemy engineer platoon attempting to emplace an obstacle and a single mobility-killed OPFOR infantry fighting vehicle while moving to the ABF position.

During Exercise 4, the platoon continues its move to the ABF position in accordance with the FRAGO. The platoon sets in its ABF position and engages elements of the advance guard main body (AGMB). The platoon leader tracks the lead elements of the AGMB from digital contact and spot reports obtained from the members of the platoon and sends digital IVIS reports of the enemy's movement to the team commander. On order, the platoon leader consolidates/reorganizes the platoon and sends a digital situation report (SITREP) to the commander.

Table 5 lists the tank platoon collective task training that is embedded in the exercises as designed.

Table 5

#### Tank Platoon Collective Tasks

Task	Title
17-3-0065	Conduct Troop Leading Procedures
17-3-1016	Conduct Tactical Movement
17-3-0221	Execute Actions on Contact
17-3-2450	Destroy an Inferior Force
12-3-2601	Conduct Hasty Occupation of a Platoon Battle Position
12-3-C021	Conduct Consolidation and Reorganization Activities
17-3-0219	Conduct an Attack By Fire

Source: ARTEP 17-237-10-MTP (DA, 1996)



To accommodate the changes in the tactical mission for the tank platoon from the existing CCTT structured exercises, the STRUCCTT-2 Team created a tank heavy company team operations order, a company team overlay order, and a fragmentary order for use by the O/C and the platoon leader. Tank platoon overlay and fragmentary orders were also created for use by the platoon leader as determined by the O/C. Other changes to the TSP required to provide an M1A2 tank platoon with the additional information it needs to operate digitally are discussed in the Lessons Learned section of this report.

### Formative Evaluation

Although the STRUCCTT-2 Team had planned to conduct a formal formative evaluation process for this effort, limited resources precluded the team from accomplishing some evaluation tasks. The major resource limitation was the unavailability of a regular M1A2 tank-equipped platoon to conduct a trial. An officer, assigned to the Armor School and with previous experience as a platoon leader in an M1A2 tank battalion, assisted the STRUCCTT-2 Team in its developmental testing. The Armor School provided a formal review of the M1A2 TSP developed by the STRUCCTT Team. The STRUCCTT Team gained significant insight into the M1A2 IVIS capabilities and limitations while crewing the manned modules during developmental testing and a limited trial conducted within the resources of the team.

### Lessons Learned

The current CCTT has the capability, though somewhat limited, to train M1A2 tank platoons and M1A2 tank crew members in the operation of the IVIS and its associated components. Realistic training for M1A2 tank heavy company teams is not possible without substantial hardware changes at the AAR (to allow the O/C to send and receive digital messages) and SAF workstations (to allow operators to send and receive digital messages) and software changes which could allow computer-generated digitally-equipped forces to send position updates and spot reports to a training unit's IVIS system. The CCTT-D Research Report (Dierksmeier et al., in preparation) has developed specific recommendations for CCTT enhancements which are detailed later in this note. Several other issues were identified during this effort.

### Use of an IVIS Tank

The first issue to be addressed by the STRUCCTT-2 Team was how to send digital reports and overlays to the training platoon. In order for the exercises to train the platoon on the use of the M1A2 unique capabilities, digital reports and overlays would have to be sent to the platoon. However, the CCTT system currently does not support preparing, sending, receiving or, monitoring digital traffic from the AAR workstation. Therefore an alternative method was identified. This method entails using an additional M1A2 module to act as the team commander's tank and is referred to as the "IVIS tank." The purpose of the IVIS tank is to prepare, send and receive digital reports and overlays to the training platoon. Guidance was written on manning the tank with the team commander's crew or a platoon leader's crew from a sister platoon. Additionally, the "IVIS tank" crew can provide input to the observer/controller (O/C) on the platoon's use of IVIS for inclusion in the AAR.

### Number of Modules Available

After identifying the need for using an IVIS tank to prepare, send and receive digital reports and overlays, another issue to be addressed was the number of M1A2 manned modules available for the design and development of the exercises. All design and development work took place at Fort Knox, KY. The CCTT Site at Fort Knox currently only has four M1A2 manned modules. In comparison, the Fort Hood CCTT Site has ten M1A2 modules that would allow two platoons to train simultaneously using "IVIS tanks." To address this shortfall, instructions were written for running the exercises without an IVIS tank. The instructions stated that all reports sent to and received from the platoon would be sent by voice transmission in lieu of digital transmission. Internally the platoon would still have digital communications capability. The platoon not being able to communicate with the team commander via a digital net was not considered a serious training shortfall. If anything, it represents what will be the norm until the Army has fielded a seamless digital force. For example, an M1A2-equipped tank platoon attached to a mechanized infantry team equipped with M2A2 Bradleys would not be able to communicate to the team commander via a digital net.

### Additional Information Needed for the TSP (IVIS Setup, Graphic Matrix, Reports)

As the STRUCCTT-2 Team began work on the M1A2 exercises, they determined that, while the basic TSP model used during the STRUCCTT-2 Project could be used, some additional information elements would have to be added to the TSP. Much of the additional information dealt with the digital systems of the M1A2 tank. Identifying exactly what new information needed to be included was done by reviewing appropriate field manuals and technical manuals. After reviewing these materials an initial set of IVIS-specific information was developed. The information dealt with IVIS log-on procedures and graphics or reports. One area that was initially identified but later determined not to be required was setup information for the POSNAV system. The POSNAV system in CCTT has the vehicle location and azimuth already present. This information is entered into the exercise file during exercise planning. Crews only need to verify the location given to them by the O/C during the Exercise Preview. The IVIS information for the training platoon is provided to them during the Exercise Preview. Information for the IVIS tank is provided in the IVIS Tank Workstation Execution Guidelines. Table 6 provides a listing of the additional digital information elements that were added to the TSP and its expected users.

Table 6

## IVIS Information Users

IVIS information	Training platoon	IVIS tank
IVIS Password <sup>1,2</sup>	✓	✓
IVIS User ID <sup>1,2</sup>	✓	✓
IVIS Radio Setup <sup>1,2</sup>	✓	✓
Operations Overlay Control Measure Matrix <sup>2</sup>		✓
Pre-formatted IVIS Report Matrix <sup>2</sup>		✓

Note 1: Added to TSP Exercise Chapter, Section 1, Exercise Preview.

Note 2: Added to TSP Exercise Chapter, Section 2, Workstation Execution Guidelines (IVIS Tank).

### Refresher Training for Crewmen of Digitally-equipped Combat Vehicles

To maximize the digital capabilities of their tank, whether in simulation or combat, M1A2 tank and other digitally-equipped combat vehicle crewmen need periodic refresher training. The STRUCCTT-2 Team's experience with either learning the IVIS system for some team members or relearning the system for others demonstrated the skills associated with maintaining proficiency can be readily degraded unless they are routinely practiced. Using an actual vehicle or the CCTT is not cost effective to provide this type of training. Fielding of stand-alone, personal computer systems, such as the Crew Station Trainer (CST) or the Digital Display Tabletop Trainer (D<sup>2</sup>T<sup>2</sup>), which provide M1A2 tank crew members with an opportunity to learn or sustain their digital skills should be a priority for every digitally equipped unit. To maximize leader training, these systems should be dynamically linked and simple, low cost situational training exercises should be developed for these devices. Tank commanders can then use these exercises to gain or regain digital proficiency prior to collective field or simulation training.

### Future Considerations

The CCTT-D Research Report (Dierksmeier et al., in preparation) makes several recommendations for enhancing the CCTT (Table 7). The experience the STRUCCTT Team has gained during the development of the M1A2 tank platoon exercises supports these recommendations. They should be adopted as soon as practical. Readers with an interest in structured simulation-based training programs and their development should review the CCTT-D Research Report when it becomes available.

Table 7

CCTT-D Research Project Recommendations

CCTT-D research project recommendations
<ul style="list-style-type: none"><li>• Add digital exercise management tools to AAR workstations.</li><li>• Upgrade CCTT manned modules with digital command and control systems required by existing force.</li><li>• Field CCTT operation centers/command posts with digital systems to replicate actual tactical operation centers.</li><li>• Add digital system capability to SAF and unit support workstations.</li><li>• Develop a systematic procedure to upgrade current software to digital systems.</li><li>• Expand CCTT capability to train battalion task force and brigade commanders and staff.</li></ul>

## References

- Deatz, R.C., Forrest, D., Holden, W.T., Sawyer, A.R., Britt, D.B., & Gray, R. (1998). Follow-on development of structured training for the close combat tactical trainer (ARI Research Report 1725). Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.
- Department of the Army (1995). Operator's manual: Operator controls, PMCS, and operation under usual conditions, volume 1 of 2, tank, combat, full tracked: 120-mm gun, M1A2 2350-01-328-5964, General Abrams (TM 9-2350-288-10-1). Change 6. Washington, D.C.
- Department of the Army (1996). Mission training plan for the tank platoon (ARTEP-17-237-10-MTP). Washington, D.C.
- Dierksmeier, F.E., Winsch, B.J., Leibrecht, B.C., Sawyer, A.R., Quinkert, K.A., & Wilkinson, J.G. (in preparation). Structured simulation-based training program for a digital force: Final report on approach, design, and functional requirements (ARI Research Report). Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.
- Flynn, M.G., Campbell, C.H., Myers, W. E, & Burnside, B.L. (in preparation). Structured training for units in the close combat tactical trainer: Design, development and lessons learned (ARI Research Report). Alexandria, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.
- United States Army Armor Center (1998). M1A2 tank equipment task list [On-line]. Available <http://147.238.100.101/dtdd/atda1/equipmen.htm>.